Computer Lab 05

The lab 05 deliverable will be an Arena model for Exercise 5-05 (p. 248 of text). This will entail the use of three new concepts in Arena: Variables, Expressions, and Sets.

Variables

The Variable spreadsheet on the Basic Process template allows you to define variables that can be accessed anywhere in the model. This is different from an attribute, which can only be accessed for a particular Entity when it is located at a module in the simulation. (See §5.2.3, pp. 180-1 of text). First we will use variables for the basic model (The Drill Press model from Lab 01). Open your Lab 01 model and save it as "<name>_lab05a.doe".

Select Variable and double-click where it says in the spreadsheet to add a new variable. Create a variable called "Mean Interarrival Time" and one called "Service Time Params". Click the "Initial Values" button for Mean Interarrival Time and enter 5.0 in the spreadsheet that pops up. Close the pop-up spreadsheet by clicking the 'x'.

For Service Time Params, enter '3' in the Number of rows. Then open the "Initial Values" button and enter '1.0' in the first row, '3.0' in the second row, and '6.0' in the third row. Close the pop up spreadsheet.

Now open the Create block and change the number '5.0' to "Mean Interarrival Time." You can pick this value using "Build Expression" and selecting Basic Process Variables | Variable | Current Value (making sure that "Mean Interarrival Time" is selected in the drop-down box on the right).

Now open the Drill Press Process and replace TRIA(1.0, 3.0, 6.0) with TRIA(Service Time Params(1), Service Time Params(2), Service Time Params(3)). Sine Service Time Params was defined to have 3 rows, it is essentially an array. So Service Time Params(1) refers to the value in the first row, Service Time Params(2) the value in the second row, etc.

Run your model for 20,000 minutes. You should get identical results to the original. Change the mean interarrival time to another value (say 4.0) by editing the Variable spreadsheet (click on the "Initial Values" button and change the value in the pop up spreadsheet). Using variables makes it easier to observe the effects of changing values in this way.

Expressions

With the Variables spreadsheet you can easily change values. You can use the Expression spreadsheet on the Advanced Process template to build entire expressions. Open your lab 01 model and save it as <name>_lab05b.doe. Attach the Advance Process template (if it is not already there) and select the Expression spreadsheet. Define two expressions called Interarrival Time and Service Time, respectively.

To use the Build Expression dialog to create your expression, you must right-click on the "Expression Values" button and select "Edit via Dialog". Click "Add" to bring up a dialog, then right-click in the text field and select "Build Expression." For Interarrival Time, create the expression EXPO(5.0), and for Service Time build TRIA(1.0, 3.0, 6.0).

Now edit the Create module so that the time between arrivals is an Expression, "Interarrival Time." The Interarrival Time expression can be selected from the "Build

Expression" dialog: select Advanced Process Variables | Expression | Value and choose "Interarrival Time" from the drop-down box on the right. Similarly, change the Process module to use the expression "Service Time." Running your model for 20,000 minutes should again produce identical results as before.

You can easily change the expressions. Change the interarrival time distribution to Uniform(1.0, 5.0) and the service time distribution to Gamma(1.2, 2.3) and run the model again.

Sets

Sets can be used to group similar, but distinct, objects together. For this lab, we will use a Set to contain the four Operators, which will be defined as Resources.

First define a Set called "Operators" and then add four "rows" of Resources called "Operator x" where x = 1,2,3,4. Then define Expressions for the interarrival times (1 row) and the Assembly times (4 rows) using the distributions given in the problem. Finally, define a Variable called "Rework Factor" that has initial value 1.3. This represents the 30% increase in time when reworking.

For the flow of the simulation, use a Process for the Assembly operation and separate Seize, Delay, and Release modules for the rework operation. A Decide module connects the two (representing the 7% defectives).

For the Assembly Process, define the Resource as a "Set" and choose "Operators". Also, let "Operator ID" be the "save attribute." This stores the id of the particular operator chosen in an attribute. The processing time should be an Expression that is AssemblyTimes(Operator ID). That is, the index of the Expression "Assembly Times" is given by the "Operator ID" attribute. After defining the Assembly Process module, select the Queue spreadsheet and check "Shared." That is because the rework queue will be the same as for the incoming kits.

The Seize module for rework should add another Set "Resource" but this time request a "specific member" that is given by the "Operator ID" attribute. The Delay module should use both the Assembly Times expression (with the Operator ID index) times the Rework Factor variable. Finally, the Release module should release the "specific member," the Operator ID attribute. Be sure that the reworked fan is checked again – it may need to be reworked as many times as necessary until it "passes."

Delieverable

Save your model of Exercise 5-05 as <name>_lab05c.doe and submit only this (zipped if possible) file by Monday, 23 February.